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OUR LARGEST STANDING ARMY: THE BIRDS.

By Clarence Moores Weed.

ONE of the results which the study of insects has repeatedly verified is that, as a rule, the greatest damage to cultivated crops is done by those species of insects or other animals that fluctuate greatly in numbers. Nearly all the insect pests of first importance, like the army worm, the canker worm, the Hessian fly, and many others, are sometimes so scarce that they are not noticed, while at others they become overwhelmingly abundant.

Any agency which tends to establish an equilibrium in their numbers and thus to prevent their undue increase is a beneficent one. The birds are the creatures to whom we most naturally turn for help of this sort, and in this brief paper I wish to call attention to some remarkable investigations undertaken to determine whether in the presence of an extraordinary outbreak of a given insect the birds vary their food rations by taking unusual numbers of the species in question. If they do, evidently they assist in reducing the pest to its normal limits; if they do not, they neglect an opportunity for usefulness.

It need scarcely be stated here that one of the strongest arguments for the protection of birds must be found in definite scientific studies of their food. If we can prove that the birds are absolutely essential to the successful production of crops we have an argument which must appeal forcefully even to the most practical of the so-called practical men.

A few years ago a large apple orchard in central Illinois was severely attacked by canker worms. As a result of their depredations a considerable part of the orchard had the appearance, at a little distance, of "having been ruined by fire." To determine whether the birds of the region were exerting themselves to check this outbreak, Prof. S. A. Forbes visited the orchard for two successive seasons, shooting each time a number of birds of the various species present. The stomach contents of these were afterwards carefully examined. From the published record of the results (Bulletin Illinois State Laboratory of Natural History) I have made the following summary:

Nine robins had eaten only animal food, of which canker worms formed twenty per cent., cutworms twenty-eight per cent., and vine chafers fourteen per cent., making a total of sixty-two per cent. for these three groups of insects. Eleven per cent. of the remainder consisted of click beetles *(Elateridæ)*. Fourteen cat-

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The Kingbird.

birds were examined; they had eaten fifteen per cent. of canker worms, ten per cent. of cutworms and other caterpillars, fourteen per cent. of ants and thirty-three per cent. of vine chafers. Four brown thrushes had eaten canker worms, vine chafers, June beetles, click beetles, ground beetles, and other insects. Combining these food elements of twenty-seven members of the thrush family, Professor Forbes found that "none of them had eaten any vegetation whatever"; that "ninety-six per cent. of their food consisted of insects (myriapods and earth-worms making up the remaining four per cent.); that sixteen per cent. were canker worms and only four per cent. predaceous beetles." The vine chafer made just twenty-five per cent. of the entire food.

The most important element in the food of five blue birds was the vine chafer (thirty-six per cent.), while canker worms formed twelve per cent. Two black-capped chickadees had eaten only canker worms and beetles, the former making sixty-one per cent. of the food, and the latter belonging principally to a wood-boring beetle of the genus *Psenocerus*. Nearly half the food of several house wrens consisted of canker worms.

Passing now to the warblers *(Miniotiltidæ)*, we come to many species feeding very largely on canker worms. Four fifths of the food of a single Tennessee warbler consisted of these insects. Two thirds of that of five summer yellow birds was canker worms, and the same was true of two chestnut-sided warblers, and also of four black-pole warblers. A single black-throated green warbler had eaten seventy per cent. of canker worms; and two Maryland yellow throats had eaten forty per cent. of these and forty per cent. of other caterpillars. Consequently canker worms composed nearly or quite two thirds of the food of these fifteen warbles.

Seventy-nine per cent. of the food of three warbling vireos consisted of caterpillars, more than half of them being canker worms.

Out of a flock of about thirty cherry birds or cedar waxwings, seven birds were shot. With the exception of a few *Aphodii* (small beetles) eaten by three of the birds in numbers too insignificant to figure in the ratios the entire food of all these birds consisted of canker worms, which therefore stand at an average of 100 per cent. The number in each stomach determined by actual count ranged from 70 to 101, and was usually nearly 100. Assuming that these constituted a whole day's food, the thirty birds were destroying 3,000 worms a day, or 90,000 for the month, during which the caterpillar is exposed.

A specimen each of the cliff swallow, American goldfinch, and yellow-winged sparrow had eaten no canker worms. About one third of the food of eight chipping sparrows consisted of caterpillars, half of them being canker worms. Three field sparrows had eaten largely of canker worms and various beetles. Forty-three per cent. of the food of fourteen black-throated buntings consisted of canker worms, and a very few of these worms had been eaten by two rose-breasted grosbeaks. They also formed 59 per cent. of the food of eighteen indigo birds.

No canker worms occurred in the stomach of a single cow bird and two red-winged blackbirds. Three Baltimore orioles, however, had eaten 40 per cent. of these worms and 50 per cent. of vine chafers. Two orchard orioles made even a better showing. "More than three fourths of the food of these consisted of canker worms and other caterpillars made an additional 20 per cent." Three bronzed grakles had eaten no caterpillars.

Passing now to the family of flycatchers we find that more than one fourth of the food of three kingbirds consisted of canker worms and fully one half of vine chafers. The food of three wood pewees consisted entirely of flying insects. Two specimens of Traill's flycatcher had eaten 25 per cent. of canker worms, and a single yellow-bellied flycatcher had eaten an equal percentage of vine chafers, but no canker worms. A single black-billed cuckoo had eaten canker worms, 75 per cent., other caterpillars 20 per cent., and vine chafers 5 per cent. Four red-headed woodpeckers had eaten 15 per cent. of canker worms, while a single golden-winged woodpecker had eaten only ants. No canker worms were found in one mourning dove and two quails.

Summarizing the above results into one general statement it is found that 141 specimens belonging to 36 species were studied. "Twenty-six of these species had been eating canker worms, which were found in the stomachs of 85 specimens. That is to say, 72 per cent. of the species and 60 per cent. of the specimens had eaten the worms. Taking the entire assemblage of 141 birds as one group, we find that 35 per cent. of their food consisted of canker worms."

A comparison was made in the case of the robin, catbird, black-throated

The Blackburnian Warble

bunting, and indigo bird of the food in this orchard, and that of the species during May under ordinary circumstances. The results showed that there was a general diminution of vegetable and miscellaneous food in the orchard specimens to compensate for the increase of caterpillars.

The Red-winged Blackbird

"Three facts," says Professor Forbes, "stand out very clearly as the result of these investigations:

"(1) Birds of the most varied character and habits, migrant and resident, of all sizes, from the tiny wren to the blue jay, birds of the forest, garden, and meadow, those of arboreal and those of terrestrial habit, were certainly either attracted or detained here by the bountiful supply of insect food and were feeding freely upon the species most abundant. That thirty-five per cent. of the food of all the birds congregated here should have consisted of a single species of insect is a fact so extraordinary that its meaning cannot be mistaken. Whatever power the birds of this vicinity possessed as checks upon destructive irruption of insect life, was being largely exerted here to restore the broken balance of organic nature. And while looking for their influence over one insect outbreak we stumbled upon, at least, two others, less marked, perhaps incipient, but evident enough to express themselves clearly in the changed food ratios of the birds.

"(2) The comparisons made show plainly that the reflex effect of this concentration on two or three unusually numerous insects was so widely distributed over the ordinary elements of their food that no especial chance was given for the rise of new fluctuations among the species commonly eaten. That is to say, the abnormal pressure put upon the canker worm and vine chafer was compensated by a general diminution of the ratios of all the other elements, and not by a neglect of one or two alone. If the latter had been the case, the criticism might easily have been made that the birds in helping to reduce one oscillation were setting others on foot.

"(3) The fact that with the exception of the indigo bird, the species whose records in the orchard were compared with those made elsewhere, had eaten in the former situation as many caterpillars, other than canker worms, as usual, simply adding their canker worm ratios to those of other caterpillars, goes to show that these insects are favorites with a majority of birds."

One of the most notable series of studies upon the relations of birds to outbreaks of injurious insects was that carried on for thirteen years by Professor Samuel Aughey of the University of Nebraska, concerning the extent to which birds feed upon the Rocky Mountain locust or grasshopper during the periodical outbreaks of that insect. Fortunately the results of these studies have been preserved by the United States Entomological Commission. (First Report, Appendix II.)

Between 1865 and 1877 Professor Aughey made out-door observations of living birds and in-door examinations of stomach contents. His tabulated results show conclusively that birds of all kinds were doing their best to reduce the numbers of the locusts: A brief summary of the principal facts will indicate the truth of this.

Beginning with the thrushes and their allies we find that six robins had eaten 265 locusts; that three wood thrushes had taken 68 locusts; that one hermit thrush contained 19 locusts; that two olive-backed thrushes were responsible for the death of 55 'hoppers, while two Wilson's thrushes had destroyed 73 more. Five catbirds had eaten 152 of these insects.

Sixty-seven locusts were taken from the stomachs of three blue birds, and 29 from one little ruby-crowned kinglet, while four tufted titmice yielded 250 of the pests, and nine long-tailed chickadees contained 481 of them. Four slender-billed nuthatches—the western representative of the white-bellied nuthatch—had eaten 93 locusts. Even the little warblers ate many of the pests, naturally choosing the younger specimens. Seven golden warblers had taken 77 locusts and 176 other insects. Five black-throated green warblers contained 116 'hoppers and 104 other insects. Four black-poll warblers had eaten 123 locusts, varying their diet with 47 insects of other kinds. Eight prairie warblers devoured 116 of the locusts, and greater number of other insects: while the golden-crowned thrush had fed both upon the 'hoppers and their eggs. Many warblers were seen feeding their nestlings with young locusts.

While the warblers paid most attention to the immature grasshoppers, the swallows fed chiefly upon the adult winged insects, probably catching them in the air. Seven barn swallows had eaten 139, eight eve swallows, 326, five bank swallows, 104, and ten purple martins, 265 locusts.

The vireos and shrikes were found to eat many of the pests, while some of the grosbeaks and finches ate the eggs as well as the hoppers. Three bobolinks had devoured an average of 14 locusts each, while nine meadow larks had taken 213 of the pests besides some of their eggs. Fifty-one locusts were taken from

The Phœbe Bird.

the stomach of a single yellow-headed blackbird, while the Baltimore oriole, Brewer's blackbird and the purple grakle were noted as feeding almost exclusively upon the pests when the latter were abundant.

Even the raven, the crow, the magpie, and the blue jay followed the prevailing fashion in the feathered world, eating large numbers of the locusts, although no doubt they did n't wholly neglect the occupants of any of the nests of the smaller birds with which they came in contact. The fly catchers and pewees proved to be doing good service, while the stomachs of the whippoorwill and nighthawk were crowded with 'hoppers, 348 being taken from seven specimens of the latter species.

The Quail.

It seems almost incredible that the tiny ruby-throated humming bird should also have followed the fashion, yet Professor Aughey assures us that a specimen caught by a cat had four small locusts in its stomach. After this we are prepared to learn that the stately kingfisher varies his scaly diet with an occasional 'hopper. Nor is it surprising that ten specimens of the highly insectivorous yellow-billed cuckoo had eaten 416 locusts as well as 152 other insects.

The woodpeckers evidently varied their usual diet to an extraordinary degree on account of the presence of the grasshoppers. Six hairy woodpeckers had taken 157 locusts, and 193 other insects; four downy woodpeckers had eaten 165 locusts and 90 other insects; five yellow-bellied woodpeckers contained 130 'hoppers and 93 specimens of other species; six red-headed woodpeckers had devoured 149 locusts and 200 other insects; while eight flickers contained 252 of the 'hoppers against 149 insects of other species.

The extent to which the birds of prey fed upon the locusts would surprise the many people who look upon hawks and owls only as enemies of the poultry yard deserving extermination. One barn owl had eaten 39 locusts, 22 other insects, and a mouse. Eight screech owls contained 219 'hoppers and many more other insects, while nine burrowing owls had devoured 318 locusts. The hawks patterned after the owls. Six marsh hawks ate 249 locusts, while two Swainson's buzzards had devoured 129 of the pests.

Even the pigeons and gallinaceous birds which usually feed so largely upon grains and seeds added a considerable proportion of locusts to their diet. Professor Aughey writes that in locust years the wild turkey makes the pests its principal food. Four sage cocks had eaten 190 grasshoppers, while the sharp-tailed grouse, prairie hen, and quail ate enormous numbers of them.

Passing now to the "shore birds" the records of the golden plover, the American snipe, the various sandpipers, godwits, tattlers, and curlews all tell the same story of locust destruction. Even the great blue heron, American bittern, and sand hill crane devoured the pests, while the rails and American coot added their efforts to subdue them. The snow goose, the Canada goose, and the various ducks—including the mallard, dusky duck, pintail, and blue-winged teal—contained quantities of 'hoppers. Two out of five white pelicans examined had varied their diet of crayfish and frogs by picking up locusts—one containing 41 and the other 67 specimens.

The gulls, including the black-backed, herring, ring-billed and Franklin's rosy gull, had eaten many grasshoppers, as had also the least and black tern.

It certainly would be difficult to obtain more striking evidence than this concerning the utility of birds in checking outbreaks of injurious insects. The fact that birds of all sorts and sizes, from the giant pelican to the tiny humming bird—birds of the prairie, the forest, the air, the shore, the sea, and the inland lake—fed to so large an extent upon the locusts proves beyond doubt that these feathered allies were using to its fullest extent a tremendous force to check the ranks of the invaders.

The birds have well been likened to a great standing army which can be concentrated at short notice upon any locality where an enemy appears. These records certainly show that the army is one that can be depended upon for active service in time of need.

OLD MAN OF THE MOUNTAIN
JOHNSON SC

THE VAUGHANS: A CALIFORNIA IDYL.

By Sarah Fenton Sanborn.

CHAPTER XI.

THE Vaughans traveled leisurely and sensibly. The susceptible boy drank rich draughts of storied lore as they sailed over the lakes of Killarney, explored the land of Burns and Scott, lingering for long in the literary shrines of Edinburgh. They watched the midnight sun in the far north and were charmed with the Scandinavian traditions as well as the customs and gracious politeness of the people.

Mr. Vaughan resolved to make further study of the Icelandic mythology. He had long believed the ancient Gaelic saying that Scandinavia was the mother of the nations, and that it had given more to us than even the Saxons and Anglos. Among the English lakes, Rydal Mount, Keswick and Grasmere were as household words. And at Oxford where hoary antiquity makes learning venerable, how quickly flew the hours searching the treasures of the Bodleian library and visiting the classic halls.

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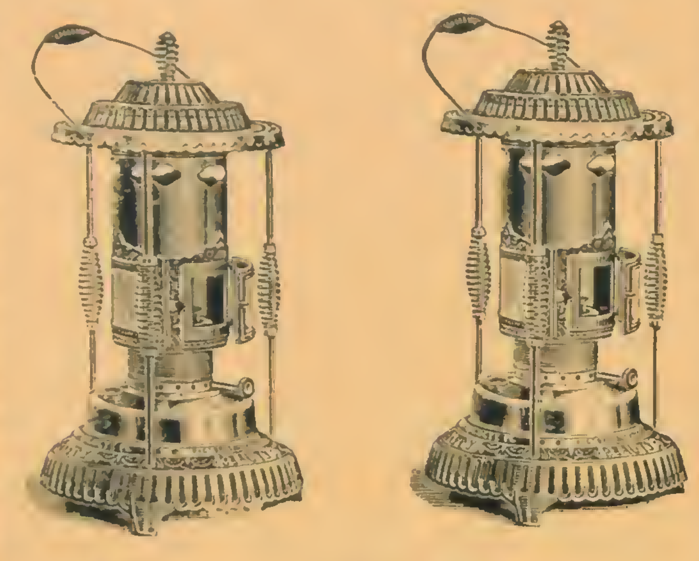

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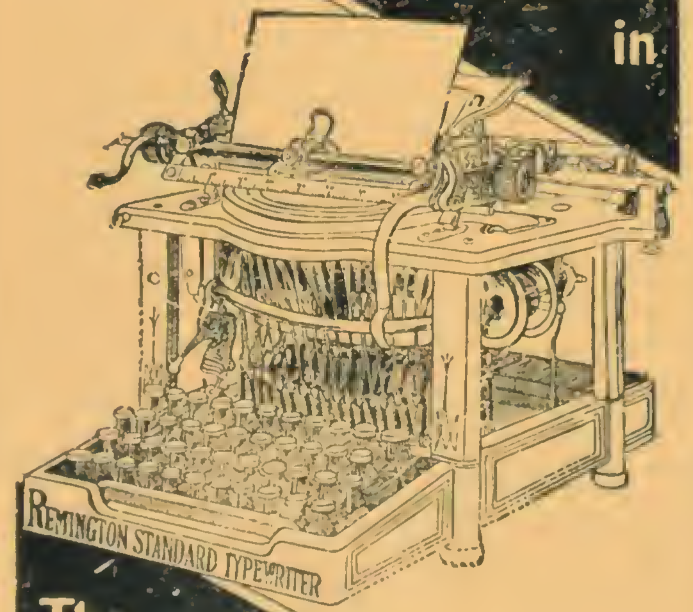

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